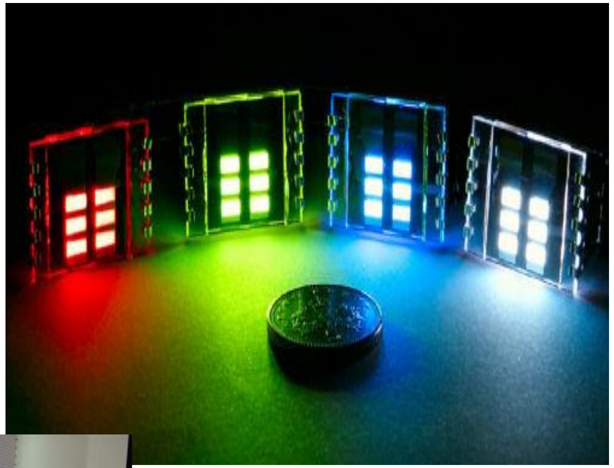
ISTANBUL TECHNICAL UNIVERSITY
FACULTY of ARTS and SCIENCE
Prof. Turan OZTURK'S ORGANIC MATERIALS CHEMISTRY RESEARCH GROUP

SYNTHESIS and CHARACTERIZATION of THIENOTHIOPHENE and BORON CONTAINING MOLECULES FOR OLED APPLICATIONS

Recep ISCI*, Pelin ULUKAN

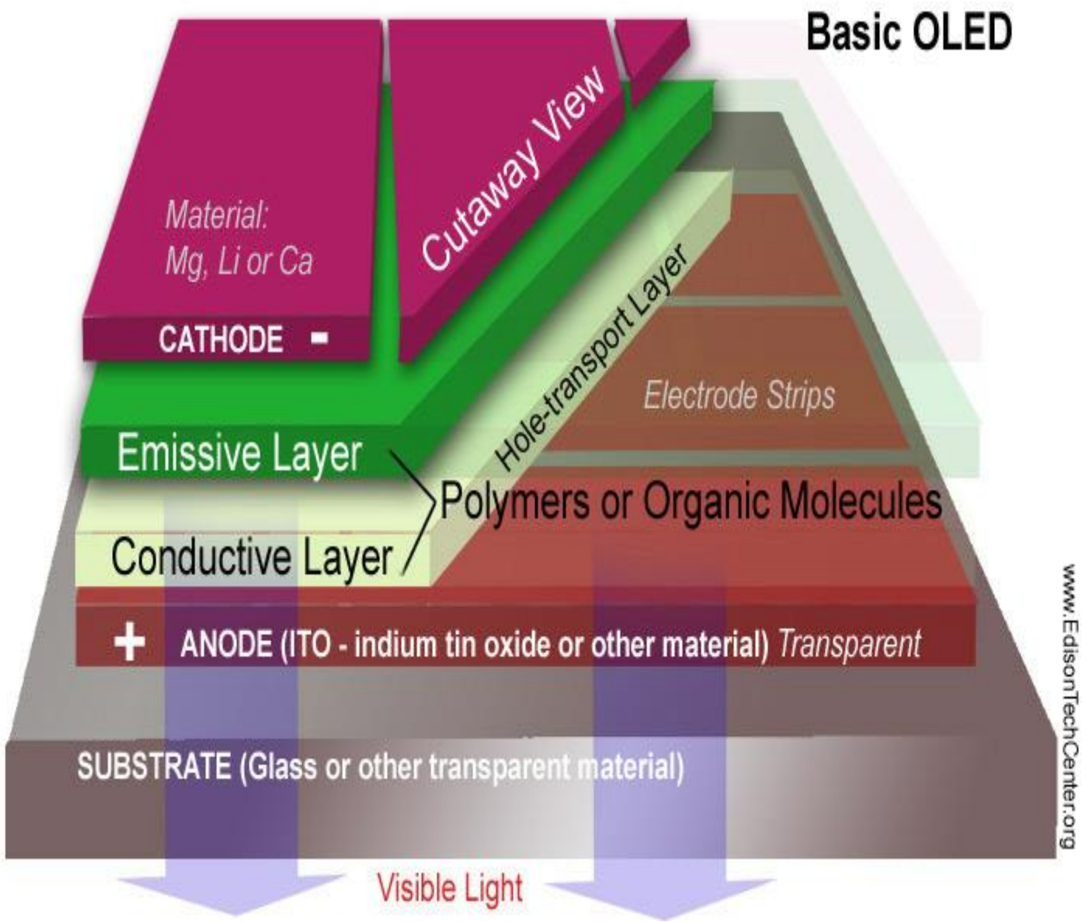
SUPERVISOR : Prof. Dr. Turan ÖZTÜRK

Organic Light Emitting Diodes



An OLED is made by placing a series of organic thin films between two conductors. When electrical current is applied, a bright light is emitted.

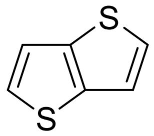
OLED Structure



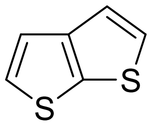
1.attach a voltage (potential difference) across the anode and cathode.
2.As the electricity starts to flow, the cathode receives electrons from the power source and the anode loses them (or it "receives holes," if you prefer to look at it that way).
3. added electrons are making the emissive layer negatively charged (similar to the n-type layer in a junction diode), while the conductive layer is becoming positively charged (similar to p-type material).
1.Positive holes are much more mobile than negative electrons so they jump across the boundary from the conductive layer to the emissive layer. When a hole (a lack of electron) meets an electron, the two things cancel out and release a brief burst of energy in the form of a particle of light—a **photon**, in other words.

THIENOTHIOPHENES

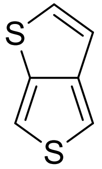
- ✓ Luminescence,
- ✓ Fluorescence,
- ✓ Photochromism,
- ✓ Nonlinear optic,
- ✓ Transistors,
- ✓ Capacitors,
- ✓ Conductive Polymers,
- ✓ Charge Transfer Complexes,
- ✓ OLEDs,
- ✓ Photovoltaic Cells.



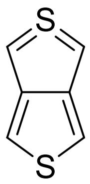
Thieno[3,2-*b*]thiophene



[2,3-*b*]



[3,4-*b*]

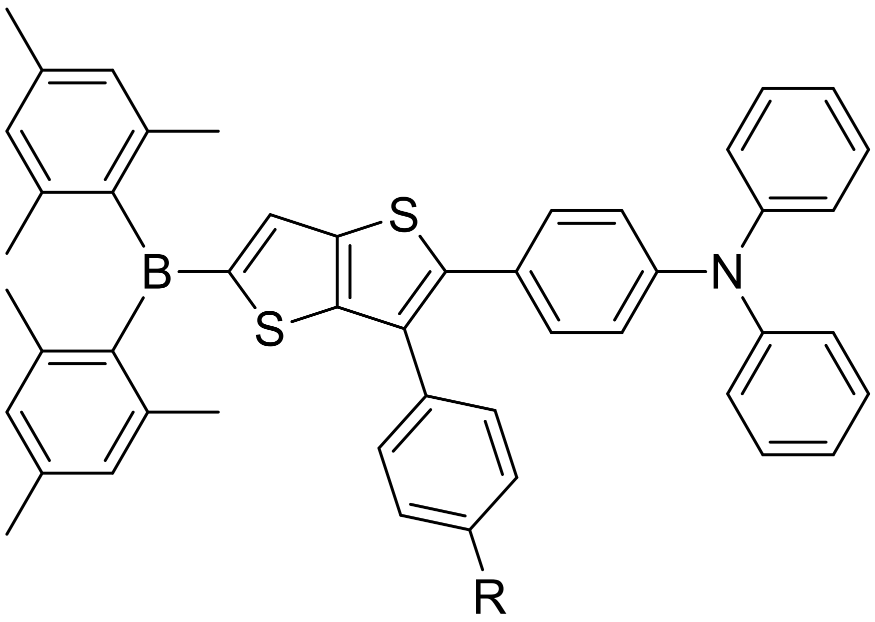


[3,4-*c*]

- ✓ Rich in sulfur.
- ✓ Good electron donors.
- ✓ Good electron delocalization.
- ✓ Building block of many electronic and optoelectronic materials.

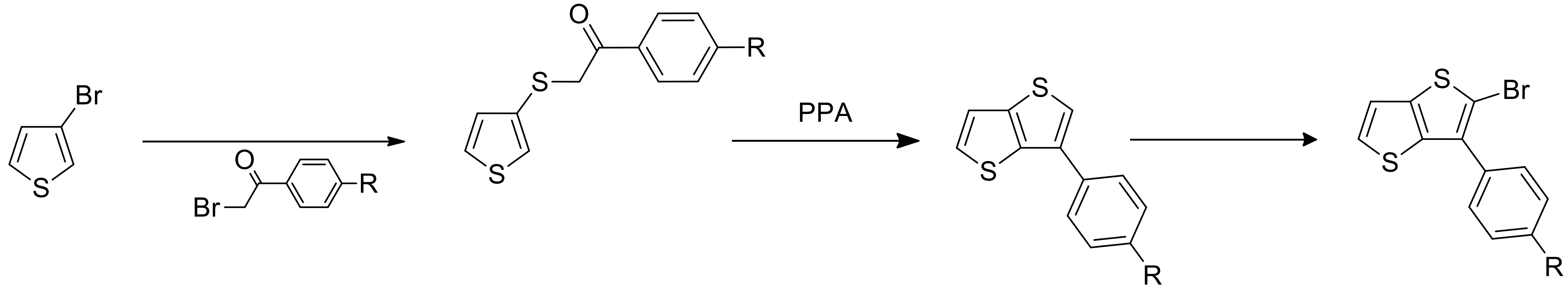
Mabkhot, Y.N., Al-Majid, A.M., Alamary, A.S., Warad, I., Sedigi, Y. (2011) *Reactions of Some New Thienothiophene Derivatives*. Molecules. **16**:p. 5142-5148.

Synthesized OLED Molecules



R: F, CN

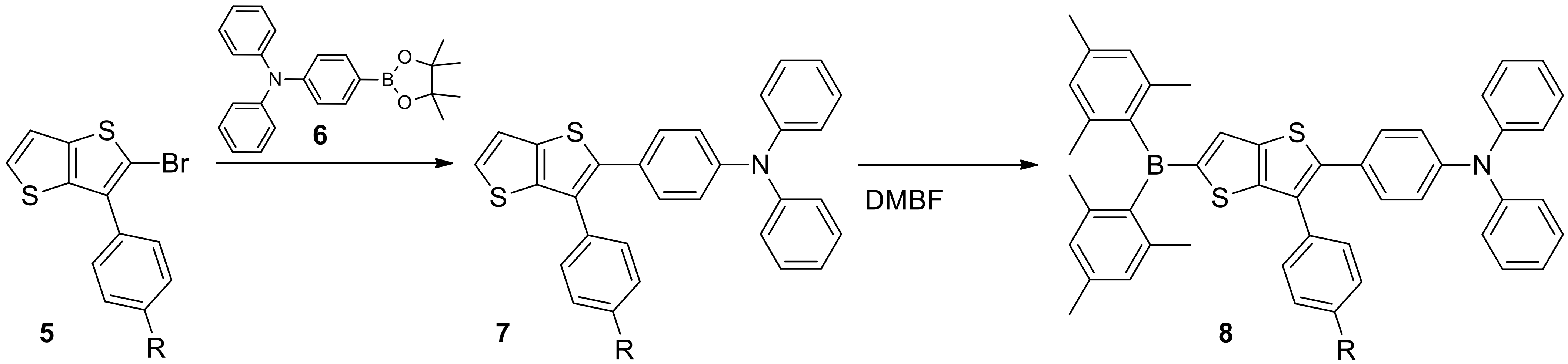
Experimental



1 2 3 4 5

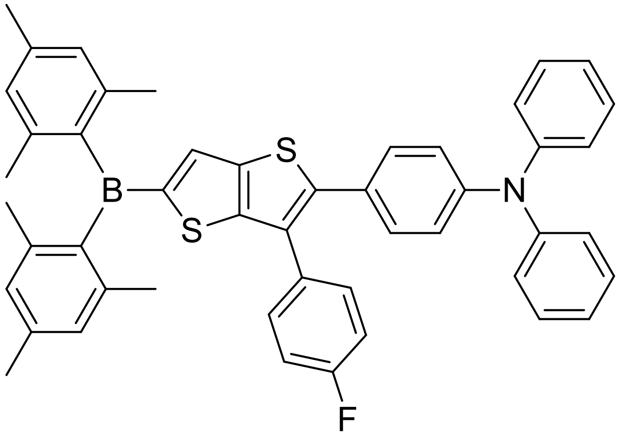
- Initially , we started our synthesis with the monoketone reactions. Then we have synthesized our thienothiophene product which is the ring closure step. Then, we did the selectively bromination reaction in order to get the target molecule 5. We have brominated our product in order to make it ready for the suzuki coupling reaction in the next step.

Experimental

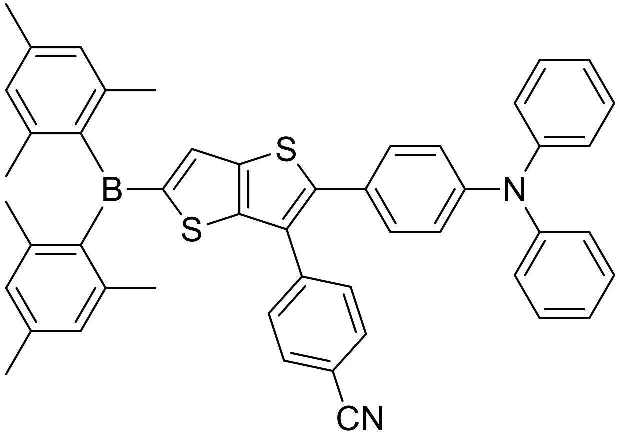


- In order to get our target molecule, we have reacted our brominated TT molecule with the reactant 6, and we have obtained the product 7 which is the TT-TPA molecule. Then, in the last step we reacted our molecule with dimesityl boron fluoride and we got the product 8.

Results



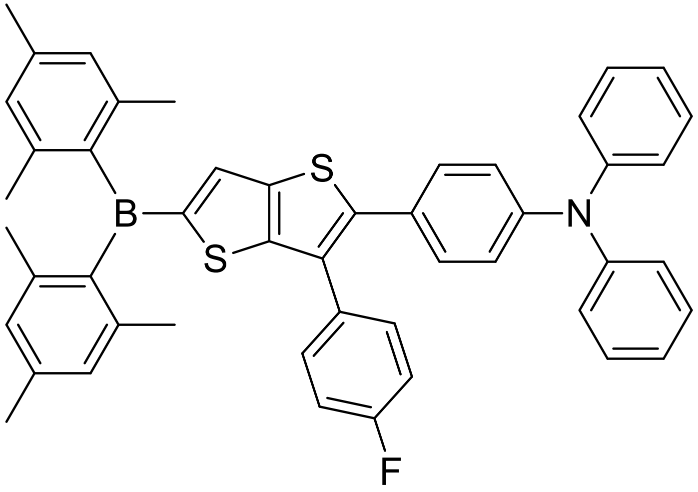
BMes-F-TT-TPA
Yellow solid product
(QY: **0.824**)

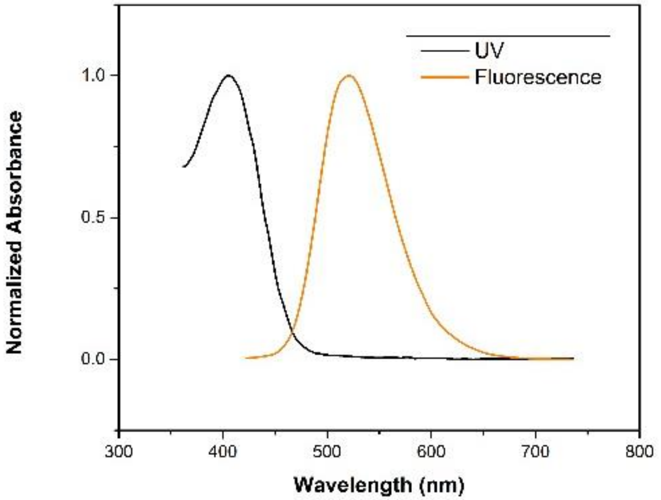


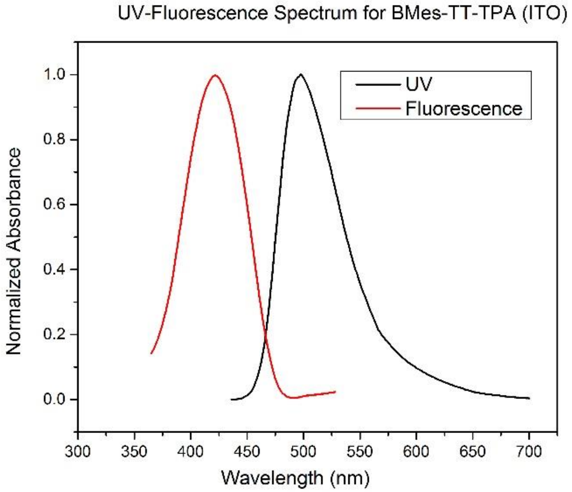
BMes-F-TT-TPA
Yellow solid product
(QY: **0.680**)

QY: Quantum Yield

Results

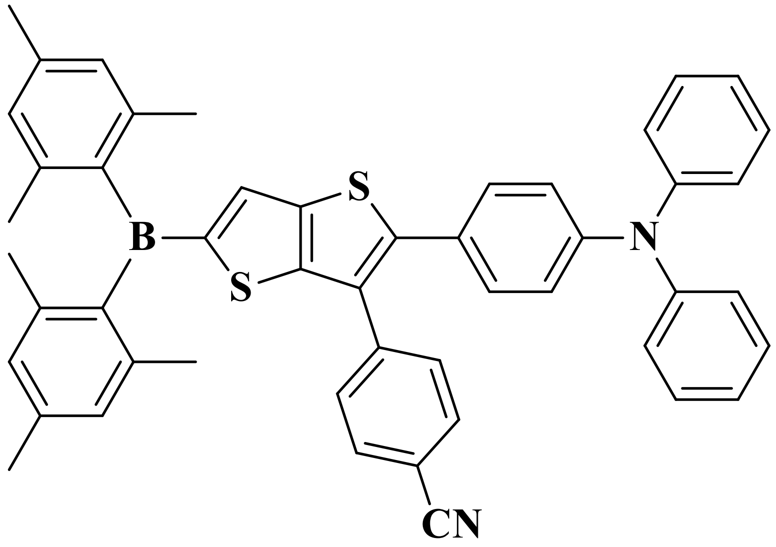


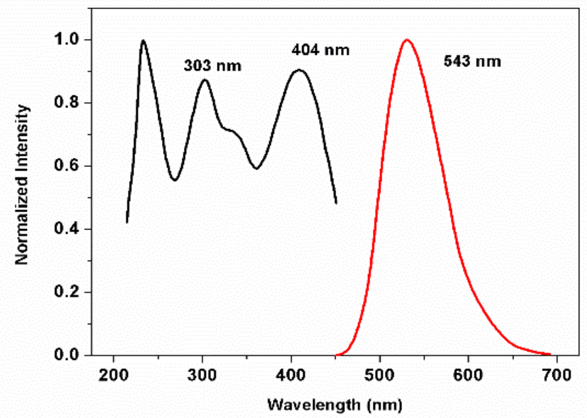


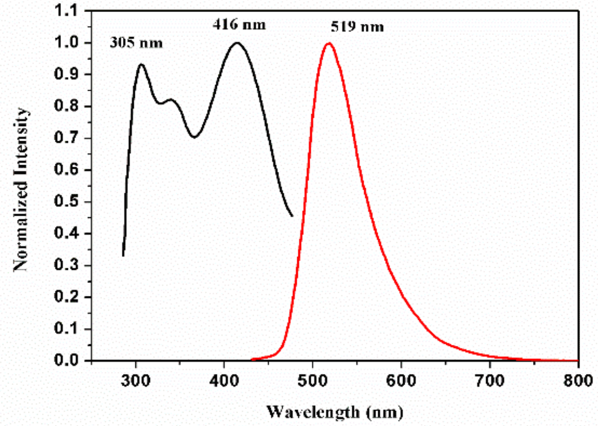


Scheme : UV-Visible and Fluorescence graphs in THF and in solid state respectively.

Results







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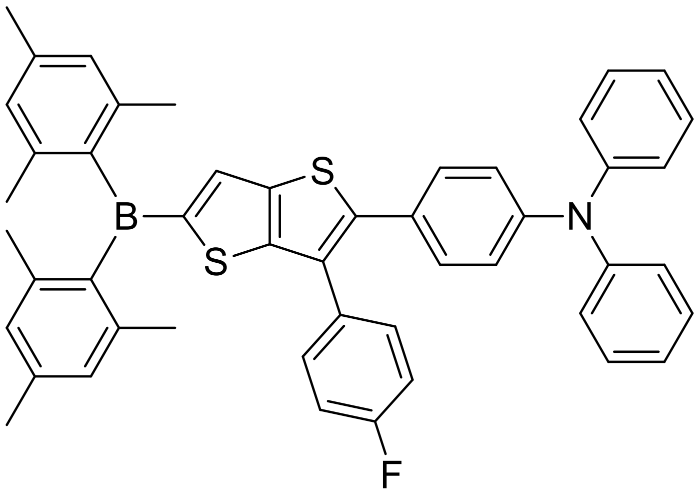

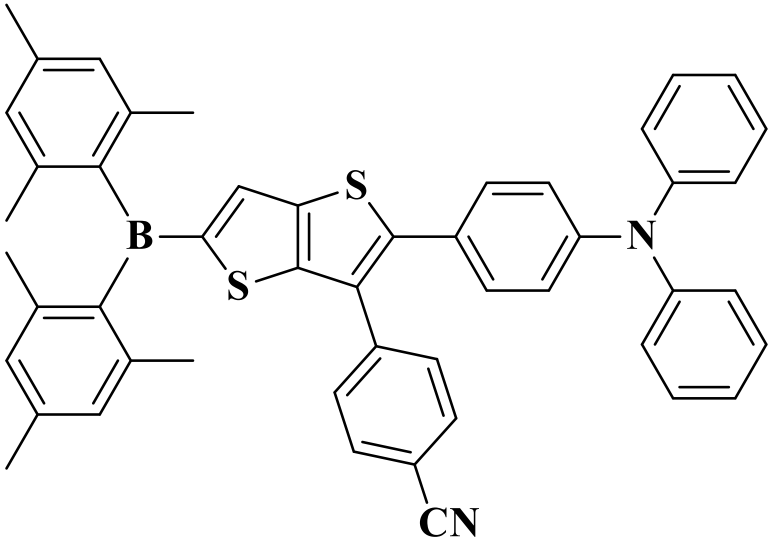

Madde	λmax[a] [nm]	λmax[b] [nm]	λmax[c] [nm]	λmax[d] [nm]		
R= F	406	520	421	498		
R= CN	404	543	416	519		

[a] Absorption maximum in THF. [b] Emission maximum in THF. [c] Solid state absoption maxium. [d] Solid state emission maximum.